

Electronic Supplementary Material (ESI) for Nanoscale
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Supporting Information for

Enhanced efficiency of graphene-silicon solar cells by electric field doping

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In our experiment, The P(VDF-TrFE) layer had been optimized in terms of the coverage rate of the P(VDF-TrFE) crystalline grain on the Si substrate by controlling the concentration of the P(VDF-TrFE) solution used for spin-coating. As shown in **Figure S1**, the P(VDF-TrFE) layer obtained by applying 0.02 wt% P(VDF-TrFE) solution contains crystalline grains with diameter of ~200nm and height of ~15 nm, covering 10-20% of the Si substrate. As the P(VDF-TrFE) solution increasing to 0.2wt%, the P(VDF-TrFE) layer consists of rod-like crystalline grains with length of ~200 nm and height of ~15 nm, covering 30-40% of the Si substrate. As the P(VDF-TrFE) solution increasing further to 2wt%, the rod crystalline grains grown longer, but the height of the gain is still ~15 nm, covering 70-80% of the Si substrate. **Table S1** shows the performance of Gr-P(VDF-TrFE)-Si solar cells integrating different kind of P(VDF-TrFE) interlayer before and after polarization. It is found that Gr-P(VDF-TrFE)/0.02wt%-Si solar cell has the highest original efficiency, but its improvement after polarization is much less (relative 6% gain) due to the low electric field doping effect. On the other hand, the Gr-P(VDF-TrFE)/2wt%-Si solar cell has higher efficiency improvement (relative 20% gain) after polarization, but its original efficiency is too low. The Gr-P(VDF-TrFE)/0.2wt%-Si solar cell, in our experiment, performs most effective to polarization and has the highest efficiency after polarization.

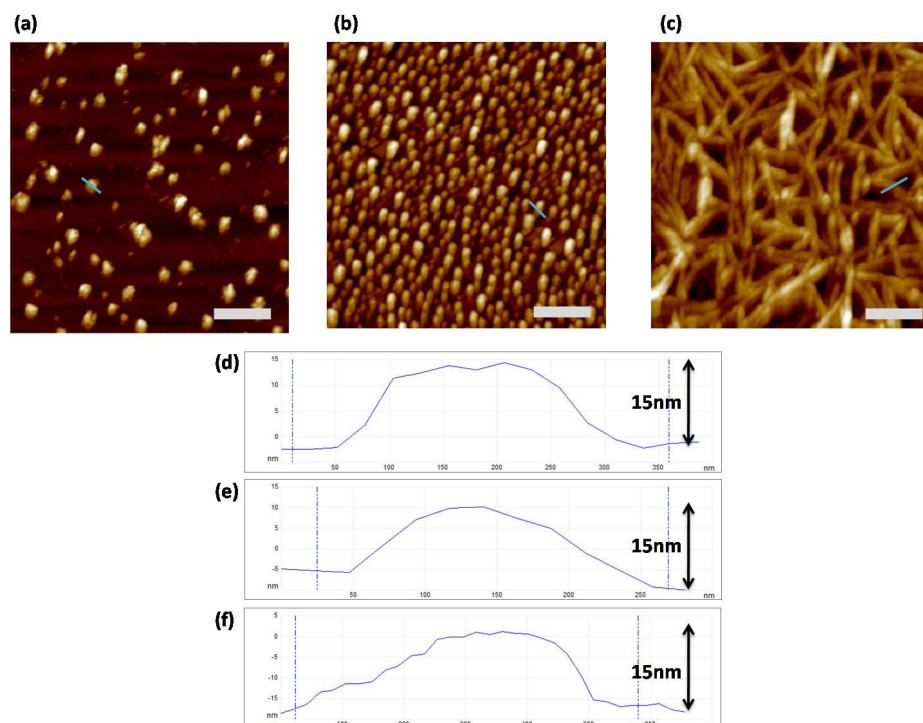


Figure S1 AFM images of crystallized P(VDF-TrFE) film obtained by spin coating P(VDF-TrFE) solution with different concentration: (a) 0.02wt%, (b) 0.2wt%, (c) 2wt%. The height profile of the P(VDF-TrFE) crystalline grain along the blue line: (d) 0.02wt%, (e) 0.2wt%, (f) 2wt%. Scale bars represent 1 μ m.

Table S1 Photovoltaic parameters of Gr-P(VDF-TrFE)-Si solar cells integrating different kind of P(VDF-TrFE) interlayer before and after polarization.

P(VDF-TrFE)	V_p (V)	V_{OC} (V)	J_{SC} (mA·cm ⁻²)	FF	η (%)
0.02wt%	0	0.45	26.0	0.30	3.51
	4	0.46	26.3	0.31	3.75
0.2wt%	0	0.45	14.8	0.30	2.01
	4	0.50	21.2	0.39	4.13
2wt%	0	0.42	4.60	0.26	0.50
	4	0.47	5.30	0.26	0.65

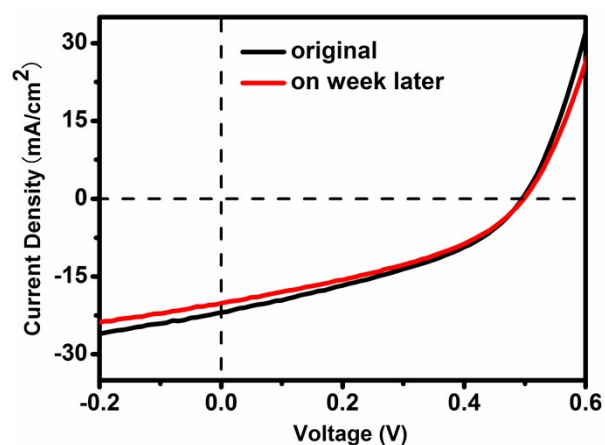


Figure S2 Illuminated current density-voltage (J - V) curves of the polarized Gr-P(VDF-TrFE)-Si solar cell at original and after one week storing.